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Initial Thinning in a Semi-Mature White and Red Pine Stand

by

D. Andison, P. Roebbelen and A.F. Beckwith

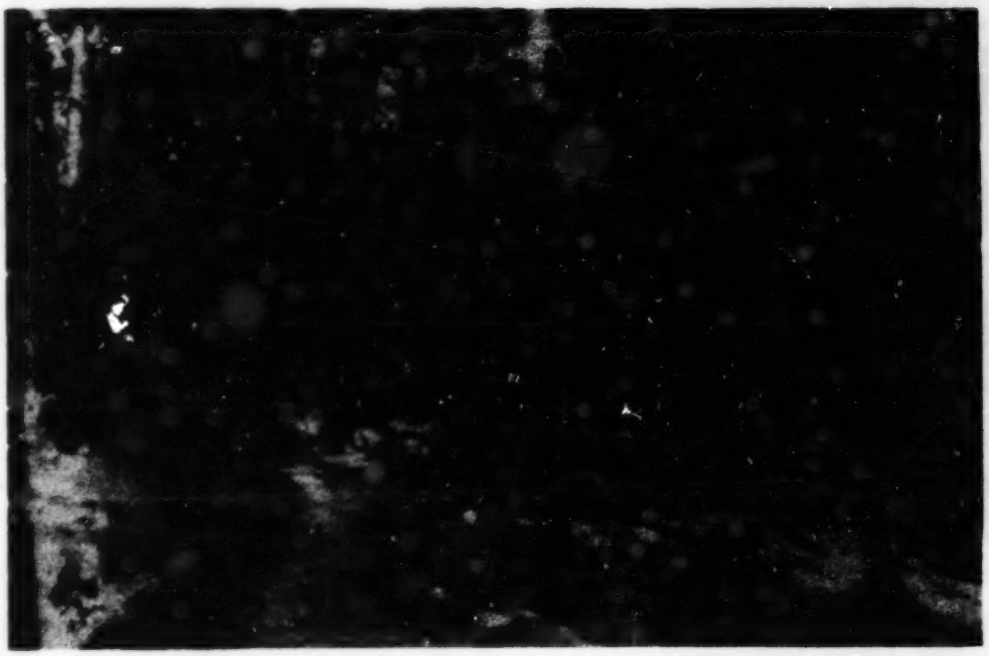

Figure 1. Control plot density at 110 years

Management of natural white and red pine (Pinus strobus L. and Pinus resinosa Ait.) stands in the Algonquin region is of increasing importance, particularly because of the constant demand for high quality white pine sawlogs. Cutting practices a century ago removed only the best stems, and gave no thought to residual stand development. Today forest management strives for a high quality mature stand achieved through a series of improvement thinnings. The type and intensity of these thinnings can be instrumental in determining the value of the final cut. Timing is also critical to allow initial thinnings to optimize juvenile growth and later thinnings to increase the quality of stems. Ideally, thinning schedules should be determined from year one; however, management must often begin in

Ontario Ministry of Natural Resources

Hon. Alan W. Pope
Minister

John R. Sloan
Deputy Minister

Further information may be obtained from:

Ontario Tree Improvement and Forest Biomass Institute
Ministry of Natural Resources
Maple, Ontario L0J 1E0

semi-mature stands that have had no thinning other than natural mortality. It is questionable whether or not these stands will respond well to release, and initial thinning past the juvenile stage may not be economically justifiable. To enable comparison of various thinning methods combined with thinning intensities on a semi-mature stand, an experiment was established in 1952 in Stratton Township near Achray (Con. VI, VII, Lots 25, 26 and 27)[1]. This report describes the results 25 years after the initial thinning.

Materials and Methods

In 1952, fourteen 0.4 ha (1 acre) plots were established in an 80- to 90-year-old well stocked fire origin white and red pine stand located on rapidly to very rapidly drained outwash sand flats. Figure 1 illustrates the unthinned stand density at 110 years. Within each of these plots a 0.1 ha (1/4 acre) sub-plot was located. Information from these subplots provided the basic data for this report. The stand consisted of 75% white pine, 20% red pine and 5% other species. These included jack pine (Pinus banksiana Lamb.), white spruce (Picea glauca (Moench) Voss), balsam fir (Abies balsamea (L.) Mill.), largetooth aspen (Populus grandidentata Michx.), and white birch (Betula papyrifera Marsh.). The associated species had little or no bearing on the management of the stand.

Three different thinning methods were selected for the experiment. Two plots were "free" thinned (essentially a thinning from below), four were thinned from "above", five others thinned "selectively" (from above and below) and three left as control. Within each thinning method, the various cutting intensities resulted in a range of residual basal areas. Table 1 lists the treatments and residual basal areas of the plots. The cutting took place in the fall of 1952 and spring of 1953.

Measurements taken within each plot included tree height and diameter at breast height taken before and after thinning, and every 5 years thereafter until 1967, and then again in 1978. No thinnings occurred between 1953 and 1978. Trees blown down by hurricane Hazel in 1954 are included as part of the thinning in 1952-53. This report deals only with the measurements taken after the 1953 thinning and the 1978 measurements.

Results

There is not enough basal area variation to determine a pattern of growth response within the free thinning, but the effects of thinning intensity can be seen in Table 1 within two treatments: the above and the selection. Both show a definite relationship between decreasing 1953 basal area and increasing growth response (% change). The best response from thinning is from the most heavily thinned plots (40-50%) for both above and selection thinning methods.

Figure 2 illustrates the cumulative stand volume by diameter class after thinning and in 1978, averaged for each thinning method. Based on overall stand volume, the unthinned control plots contain the most 1978 volume, yet have the least desirable diameter class volume distribution. Unlike the control plots, all thinned plots have the bulk of their 1978 volume in the top two diameter classes (>27.8 cm or 11 in.). Two methods

[1]Hughes, E.L. 1954. Thinning experiments in a white and red pine stand in eastern Algonquin Park. Unpublished file report. Ontario Tree Improvement and Forest Biomass Institute, Maple, Ont. 17 p.

TABLE 1 Summary of plot treatments and thinning responses

Treatment	Plot	Post thin basal area, 1953		1978			% Change 1953-78		
		m^2/ha	% of pre thin	B.A. (m^2/ha)	Vol.[a] (m^3/ha)	Av. dia. (cm/tree)	B.A.	Vol.[a]	Av. dia.
Control	I	35.52	100	43.20	495	20.7	22	32	31
	N	34.99	100	39.84	467	23.7	14	74	36
	A	34.79	100	42.77	496	21.6	23	33	38
	C	29.08	84	39.57	454	20.4	36	51	36
Free	H	25.77	77	37.80	451	26.0	47	54	24
	L	24.59	75	35.91	432	26.5	46	54	27
Above	G	21.41	66	32.71	384	23.0	53	68	36
	M	18.29	61	32.34	320	23.4	77	93	41
	J	16.02	54	27.48	382	22.5	72	99	42
	K	14.31	46	24.88	293	23.6	74	98	50
Selection									
	E	23.99	82	38.44	465	26.0	60	70	38
	F	18.06	62	30.84	386	36.8	71	80	48
	B	17.11	55	29.58	353	24.1	73	88	45
	D	16.87	46	30.68	371	26.4	82	98	48

[a]Volume calculated using local Product Form/D relationships and white pine equation with d_2 at half height (Roebbelen 1982).

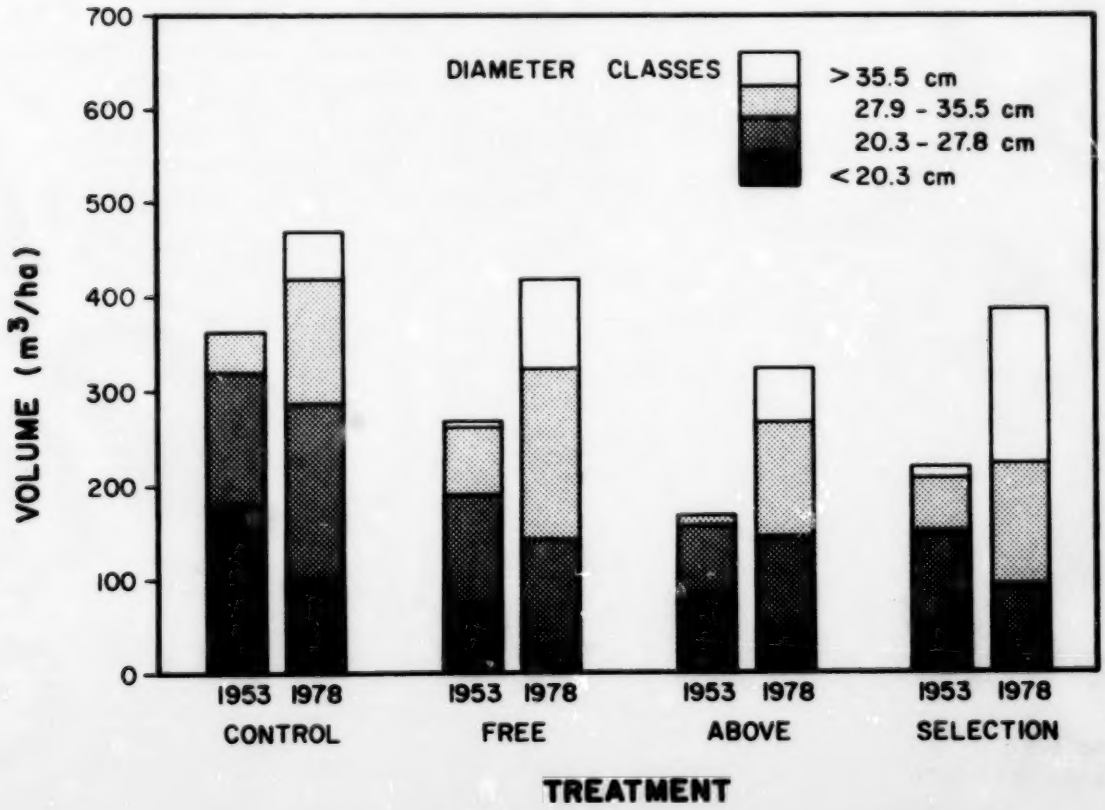

FIGURE 2 Stand volume after thinning

of thinning (free and selection) have considerably more 1978 volume in these larger more valuable size classes, while above thinning had only as much volume as the control. Selection thinning produced the highest volume of wood in the top diameter class (>35.5 cm or 14 in.). In terms of volume growth over the 25 year period, the thinned plots all produced more than the controls.

Discussion

The objective of any thinning operation regardless of age should be to increase the quantity of quality wood in the residual stand. The thinnings done at Achray have all met this objective to varying degrees. Of the three thinning methods studied, there is little doubt that selection thinning is the best option. This technique produced the greatest volume in large diameter trees and also resulted in the greatest absolute increase in total volume. These favourable results from selection thinnings may allow the reduction of rotation age for white pine. Free thinning also produced good results, although substantially fewer trees greater than 35.5 cm dbh resulted. Thinning from above responded well in terms of total volume growth, but produced significantly less volume in the larger diameter classes.

The level to which a stand is thinned (residual basal area) may be useful as a guide to optimizing the growth of the residual stand; however, not enough data are available to determine any exact relationships. The Achray data suggest that residual basal areas of 16-18 m^2/ha are reasonable within the 80-90 year age class. These heavier thinnings would certainly be more attractive from the viewpoint of early economic return.

Conclusion

The Achray thinning experiment showed that there are gains from thinning semi-mature white and red pine stands. At 80-90 years, the stand was well past the juvenile stage, yet still responded well to release. The best method of release was a fairly heavy selection thinning. However, the relatively small diameter of the trees, and the high level of stocking prior to thinning suggest that the first thinning should have been done much sooner. The gains from thinning would then be expected to be even greater than those presented in this study.

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